Horticulture Series No. 602

November 1989

GREENHOUSE TOMATO BREEDING SPRING CROP 1988 EVALUATION TRIALS, WOOSTER

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Greenhouse Tomato Breeding Spring Crop
1988 Evaluation Trials, Wooster

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In the greenhouse during a spring crop at The OARDC/OSU in Wooster, red- and pink-fruited greenhouse tomato beefsteak type cultivars and selections were evaluated. This trial completes a 2 crop cycle for these entries initiated fall of 1987. Seed for this trial was donated by The OARDC/OSU and 5 seed companies (Table 1). The response of the entries in the trial to some of the major greenhouse tomato diseases is presented in Table 2.

Materials and Methods

Five pink-fruited cultivars, 3 pink-fruited experimental lines and 10 red-fruited cultivars (Table 2) were evaluated in a replicated trial. The trial had 18 plants/entry divided into 3 replications. The trial was conducted in a greenhouse covered with polyethylene film. Seeds were sown on 11/6/87 and seedlings were transplanted into 4 inch plastic pots on 11/20/87. Seedlings received 16 hours of 22 umol $m^{-2}s^{-1}$ of supplemental irradiance during the daylight hours until transplanted into steam sterilized ground beds on 1/11/88.

There were 6 plants per row with spacing 36" between and 18" within rows. After transplanting to ground beds a starter solution of 10-52-8 (6 lbs./100 gal.), at the

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11/89-H-781-100

Table 1. Name and address of the seed companies that donated seed for the study.

Table Code		
1.	BR	Bruinsma Seed b.v., P.O. Box 24, 2670 AA, Naaldwijk, Holland
2.	DR	DeRuiter Seeds, Inc., P.O. Box 20228, Columbus, Ohio 43220
3.	NH	Nunhems, Nunhems Zaben bv, P.O. Box 4005, 6080 AA, Haelen, Holland
4.	SK	Sakata Seeds, C.P.O. Box Yokohama No. 11, Yokohama, Japan 220-91
5.	ST	Stokes Seeds, Inc., Buffalo, New York 14240
6.	OH	Ohio Agricultural Research & Development Center/The Ohio State University, Wooster, Oh 44691

Table 2. Fruit color and the response of the cultivars in this trial to some of the major greenhouse tomato diseases.[zyx]

Entry Seed Source	Fruit Color	TMV	Major Greenhouse Tomato Diseases: Fusarium Crown Root Rot (FCRR)	Fusarium Race 1 (I)	Fusarium Race 2 (I-2)	Verticillium Race 1 (Ve)	Root Knot nematode (M. incognita) (Mi)	Cladosporium Races 1&10 (C2)	Cladosporium Races 1,6,10 11&12 (C5)
Ohio 1403/OH	Pink	R	R	R	R	R	R	S	S
Ohio 1413/OH	Pink	R	R	R	R	R	R	S	S
Ohio 1499/OH	Pink	R	R	R	R	R	R	S	S
Laura/DR	Red	R	S	R	R	R	S	R	S
B82-864/DR	Pink	R	R	R	R	R	S	R	R
Caruso/DR	Red	R	S	R	R	R	S	R	R
No.29 FT-R/SK	Pink	R	S	R	S	S	S	S	S
Fireglow/SK	Pink	R	S	R	S	S	R	S	S
Firedance/SK	Pink	R	S	R	S	S	R	S	S
Camil/NH	Red	R	S	R	R	R	S	S	S
Dombello/BR	Red	R	S	R	R	R	R	R	R
2084/81/BR	Red	R	S	R	R	R	S	R	S
617/83/BR	Red	R	S	R	R	R	S	R	S
Jumbo/BR	Red	S	S	R	R	R	S	R	S
986/84/BR	Red	R	R	R	R	R	S	R	S
Dombito/BR	Red	R	S	R	S	R	R	R	S
Tropic/ST	Red	S	S	R	S	R	S	S	S
Ont. Pink 744/ST	Pink	R	S	S	S	S	S	R	S

[z]Resistant = R and Susceptible = S
[y]Fireglow and Firedance are resistant to septoria leaf spot.
[x]Ontario Pink = Ont. Pink

rate of 1/2 pint per plant, and a peanut hull mulch were applied. One month after transplanting a perforated white plastic bench film (donated by Ethyl Corporation, Visqueen Film Products Division) was laid between the rows. A drip irrigation and nutrient injection system was used to fertilize and irrigate concurrently. Based on soil test results fertigation of the plants started on 2/1/88 with 3 daily applications of water containing 452ppm KNO_3, 97ppm NH_4NO_3, 60ppm $MgSO_4$ and 41ppm H_2PO_4. On 3/11, Peter's Compound 111 mixture of micronutrients (6.7ppm) was added to this solution.

Cultural practices during the growing season were standard. Plants were hand pollinated with an electric vibrator and temperatures were 70-75 °F during the day and 62 °F night except from April to Mid-June when day temperatures ranged from 75 to 90 °F. Starting on 5/15 plants were topped when they were 6" above the 6-foot top wire.

Fruit harvesting and grading started on 4/4 and continued every week for 11 weeks. Fruit was graded into 5 classes (No. 1 large, over 255g (9 oz); No. 1 medium, from 255g to 99g (3.5 oz); No. 1 small, under 99g; No. 2; and cull) and according to 8 fruit disorder categories (puff, cracks, off-shape, rough, off-color, blossom end rot, zippered and mixed). No. 1 fruits consisted of well formed smooth tomatoes free from defects. No. 2 fruits were reasonably well formed tomatoes which were free from damage caused by physiological disorders, disease, insects or other means. Fruits were placed in the mixed category if more than one disorder occurred.

Results

There were no significant differences between the entries for any characteristics during the first 5 weeks of the study (Tables 3 and 4).

Table 3. Comparison of greenhouse tomato cultivars for graded fruit classes, yield, fruit size, and percent No. 1 and No. 2 fruit for the first 5 weeks of this trial.[z]

Entry/ Source	# of No.1 Lg./ Plt	# of No.1 Md./ Plt	# of No.1 Sm/ Plt	# of No.2 /plt	# of Culls /plt	Fruit wt/plt (g)	Fruit Size (g)	% No.1 fruit	% No.1 & No.2 fruit
Ohio 1403/OH	0.1	2.4	0.2	1.3	2.2	1191	188	44.1	64.5
Ohio 1413/OH	0.1	2.4	0.0	1.9	2.1	1226	188	42.7	70.9
Ohio 1499/OH	0.1	1.9	0.3	0.9	0.6	745	197	62.5	85.2
Laura/DR	0.4	1.3	0.0	2.3	1.5	1265	229	30.6	72.1
B82-864/DR	0.0	1.6	0.1	1.5	2.4	1156	206	28.1	54.8
Caruso/DR	0.3	2.7	0.0	4.0	1.2	1514	181	33.6	84.1
No.29 FT-R/SK	0.0	1.4	0.5	1.2	2.4	908	165	30.6	56.2
Fireglow/SK	0.0	1.9	0.4	1.6	4.5	1325	158	26.9	46.8
Firedance/SK	0.0	0.9	0.7	1.6	4.8	1126	140	19.8	39.7
Camil/NH	0.2	1.6	0.1	2.6	1.6	1136	188	31.8	74.1
Dombello/BR	0.3	1.8	0.0	3.2	2.9	1613	198	24.2	63.9
2084/81/BR	0.1	3.5	0.3	2.5	3.4	1669	171	38.8	64.4
617/83/BR	0.2	1.3	0.0	3.2	2.1	1306	193	21.6	68.2
Jumbo/BR	0.8	1.1	0.0	3.2	1.2	1436	226	31.3	81.1
986/84/BR	0.4	1.3	0.2	1.9	2.4	1268	203	30.8	61.5
Dombito/BR	0.2	1.8	0.8	4.3	1.3	1229	154	28.2	83.0
Tropic VF/ST	0.3	0.6	0.0	1.0	2.2	1001	237	17.7	48.6
Ont. Pink 774/ST	0.0	1.2	0.7	1.6	4.1	1185	149	31.2	55.3
LSD 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

[z]No. 1 fruit consists of well formed smooth tomatoes free from defects (Large over 255g [9 oz.]; Medium from 255g to 99g [9 oz.-3.5oz.]; Small under 99g). No. 2 fruit consists of reasonably well formed tomatoes which are free from damage caused by physiological disorders, disease, insects, or other means.

Table 4. Comparison of greenhouse tomato cultivars for physiological fruit disorders for the first 5 weeks of the trial.

Entry/ seed source	Disorders /fruit	% Puff	% Cracks	% Off Shape	% Rough	% Off Color	% Blossom end rot	% Zippered	% Mixed[z]
Ohio 1403/OH	0.6	0.0	25.4	8.1	47.7	5.8	9.2	4.0	39.8
Ohio 1413/OH	0.5	1.2	17.4	7.2	46.6	7.8	10.5	1.2	40.0
Ohio 1499/OH	0.4	0.0	18.9	6.8	34.7	2.6	0.9	2.6	21.8
Laura/DR	0.5	0.0	13.6	6.1	63.9	12.3	8.5	3.4	37.6
B82-864/DR	0.9	6.6	39.4	4.6	62.4	15.5	16.1	0.0	51.2
Caruso/DR	0.7	7.7	12.9	28.1	56.0	17.9	0.0	5.1	55.6
No.29FT-R/SK	0.8	1.3	39.6	7.7	43.3	11.3	10.9	0.0	55.0
Fireglow/SK	0.9	2.8	51.9	7.4	51.3	2.8	4.3	8.3	62.2
Firedance/SK	0.9	0.6	47.5	4.9	76.2	10.9	6.6	12.1	67.3
Camil/NH	0.5	1.0	9.5	9.6	73.3	10.2	1.0	3.8	30.7
Dombello/BR	0.7	0.7	28.4	10.6	67.4	3.6	8.6	2.5	46.4
2084/81/BR	0.6	0.5	27.5	6.0	49.8	16.6	4.2	0.6	48.0
617/83/BR	0.6	0.0	12.4	5.9	76.6	21.2	8.4	0.7	39.0
Jumbo/BR	0.5	2.0	18.5	5.1	62.5	12.7	3.3	0.8	37.1
986/84/BR	0.7	14.5	24.1	6.7	63.9	14.6	0.0	0.0	50.6
Dombito/BR	0.7	0.0	4.2	16.4	59.9	14.3	0.0	4.2	49.4
Tropic VF/ST	0.9	0.0	14.3	7.3	71.5	30.7	21.4	0.0	64.2
Ont. Pink 744/ST	0.7	2.9	46.3	7.4	55.6	5.0	1.4	0.0	59.8
LSD 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

[z]Percentage of the fruit that had more than one physiological disorder.

However, the pink-fruited Ohio 1400 plants tended to produce a greater percentage of No.1 fruit than the other cultivars. The entries that produced the highest percentage of early marketable fruit were Ohio 1499 (85.2%), 'Caruso' (84.1%), 'Dombito' (83.0%) and 'Jumbo' (81.1%).

The results for the entire 11 weeks of this trial indicated that the red cultivars produced more fruit and larger fruit than the pink cultivars (Table 5). However, the pink fruited Ohio 1400 plants produced a higher percentage of No. 1 fruit. The most No. 1 large fruits were produced by 'Jumbo' (2.0), 'Caruso' (1.5) and 'Laura' (1.5). The best pink entry was Ohio 1413 which produced 1.2 No. 1 large fruits per plant. 'Dombito' (7592 g/plant), 'Dombello' (7066 g/plant) and 2084/81 (6926 g/plant) were the 3 cultivars that had the highest yields. B82-864 (6151 g/plant) was the best pink entry. The cultivars with the largest average fruit size were 'Tropic' (205g), 'Caruso' (192g) and 'Jumbo' (191g). The best pink entry was B82-864 with a fruit size of 171g. Three pink selections produced the highest percentage of No. 1 fruits (Ohio 1499, 53.1%; Ohio 1403, 49.0%; Ohio 1413, 46.1%). The best red cultivar was 'Dombito' with 37% No. 1 fruit. The highest percentage of marketable fruits was produced by 'Caruso' (83.4%) and 2 pink selections, Ohio 1499 (82.1%) and Ohio 1413 (79.2%). The red cultivars with the best combination of important characteristics were 'Caruso', 'Jumbo' and 'Dombello' (total yield - 6640 g/plant, 6573 g/plant and 7066 g/plant, respectively; fruit size - 192g, 191g and 168g, respectively; and % marketable fruit - 83.4%, 71.7% and 74.6%, respectively). Ohio 1413, Ohio 1499 and B82-864 were the best pink entries for combination of yield (5936 g/plant, 5092 g/plant and 6170 g/plant, respectively), fruit size (168g, 160g and 171g, respectively) and % marketable fruit (79.2%, 82.1% and 70.3%, respectively).

Table 5. Comparison of greenhouse tomato cultivars for graded fruit classes, yield, fruit size, and percent No. 1 and No. 2 fruit for the entire 11 weeks of this trial.[z]

Entry/Seed source	# of No.1 lg/plt	# of No.1 md/plt	# of No.1 sm/plt	# of No.2 /plt	# of culls /plt	Fruit wt/plt (g)	Fruit size (g)	% No.1 fruit	% No.1 & No.2 fruit
Ohio 1403/OH	0.4	15.2	1.4	9.2	7.7	5466	162	49.0	76.2
Ohio 1413/OH	1.2	14.3	0.9	11.7	7.2	5936	168	46.1	79.2
Ohio 1499/OH	0.7	15.4	0.9	9.0	5.8	5092	160	53.1	82.1
Laura/DR	1.5	8.0	0.2	15.3	12.0	6170	167	25.7	66.9
B82-864/DR	0.4	9.9	0.4	14.6	10.6	6151	171	29.5	70.3
Caruso/DR	1.5	9.2	1.3	17.2	6.0	6640	192	35.3	83.4
No.29 FT-R/SK	0.2	11.1	1.9	8.7	7.8	4626	156	44.4	73.7
Fireglow/SK	0.1	11.4	2.1	8.9	12.9	5304	150	38.9	63.9
Firedance/SK	0.1	11.1	2.9	11.2	12.2	5381	143	37.5	67.4
Camil/NH	0.3	9.8	0.4	14.3	12.3	5828	158	28.1	66.7
Dombello/BR	0.6	13.3	0.3	17.3	10.4	7066	168	33.4	74.6
2084/81/BR	0.4	14.0	1.5	14.6	13.2	6926	159	36.1	69.8
617/83/BR	0.7	6.9	0.3	14.4	13.6	6331	176	22.4	62.7
Jumbo/BR	2.0	7.0	0.1	15.5	9.8	6573	191	26.3	71.7
986/84/BR	0.6	9.5	0.7	11.1	9.5	5126	162	33.9	69.7
Dombito/BR	1.0	12.3	4.5	19.2	11.2	7592	156	37.0	77.0
Tropic VF/ST	1.3	6.1	0.1	10.3	12.9	6336	205	23.2	57.4
Ont. Pink 774/ST	0.0	8.7	2.6	13.8	17.4	5640	131	27.3	60.4
LSD 5%	0.8	5.5	1.0	3.2	5.5	NS	13.0	11.5	10.4

[z]No. 1 fruit consists of well formed smooth tomatoes free from defects (Large over 255 g [9 oz.]; Medium from 255g to 99g [9 oz.-3.5oz.]; Small under 99g). No. 2 fruit consists of reasonably well formed tomatoes which are free from damage caused by physiological disorders, disease, insects, or other means.

The main causes for fruit rejection over the entire 11 weeks for almost all the entries was for roughness, cracking and off-color (Table 6). Some entries produced more off-shape fruit than off-colored fruit. The entry with the lowest disorders/fruit ratio was Ohio 1499 (0.3). Four entries had a disorder/fruit ratio of 0.4 (Ohio 1403, Ohio 1413, 'Laura' and 'Jumbo'). The entries with the least amount of cracked fruit were 'Laura' (8.6%), 'Tropic' (12.3%) and Ohio 1413 (13.7%). The smoothest fruit was produced by 'Caruso' (% rough, 34.7), 'Dombito' (% rough, 46.2) and Ohio 1499 (% rough, 49.4). The entries with the least amount of off-colored fruit were Ohio 1403 (2.5%), Ohio 1499 (2.7%) and Ont. Pink 774 (2.7%).

Discussion

Based on the results of this trial, the best red-fruited cultivars for a spring crop were 'Caruso', 'Jumbo' and 'Dombello'. 'Caruso' is the best choice because 'Jumbo' is TMV susceptible and the fruit of 'Dombello' is too small. However, it should be noted that all three of these cultivars are susceptible to Fusarium crown and root rot. The best pink-fruited entries were Ohio 1413, Ohio 1499 and B82-864. Ohio 1413 is the best choice because the fruit of Ohio 1499 is to small and B82-864 produces a smaller percentage of No. 1 and marketable fruits. 'Caruso' was the best red-fruited cultivar regardless of the greenhouse season of production (fall or spring) (1). In contrast, for good pink fruit production different plants should be grown in the fall and spring. For a fall crop, the best pink-fruited plants were Ohio CR-6 and Ohio 1499 (1).

Table 6. Comparison of greenhouse tomato cultivars for physiological fruit disorders for the entire 11 weeks of the trial.

Entry/ seed source	Disorders /fruit	% Puff	% Cracks	% Off Shape	% Rough	% Off Color	% Blossom end rot	% Zippered	% Mixed[z]
Ohio 1403/OH	0.4	0.1	19.4	4.2	55.5	2.5	3.6	2.7	28.1
Ohio 1413/OH	0.4	1.1	13.7	6.4	59.2	3.7	5.0	2.9	28.5
Ohio 1499/OH	0.3	0.2	15.6	4.1	49.4	2.7	1.5	1.8	22.7
Laura/DR	0.4	5.8	8.6	5.1	67.3	11.7	1.5	1.3	28.1
B82-864/DR	0.5	1.4	33.7	3.5	67.0	10.0	2.4	0.0	45.8
Caruso/DR	0.7	4.9	38.9	13.0	34.7	12.3	0.9	1.4	50.0
No. 29 FT-R/SK	0.5	1.4	28.9	7.2	55.9	5.3	5.4	0.2	40.7
Fireglow/SK	0.6	1.0	34.8	9.9	57.2	2.9	3.8	3.2	46.3
Firedance/SK	0.5	0.3	28.9	7.0	68.0	4.5	1.5	4.9	41.6
Camil/NH	0.5	3.9	14.8	9.1	70.8	11.8	0.6	1.7	36.4
Dombello/BR	0.5	1.2	21.3	6.8	64.8	6.0	2.1	0.8	35.0
2084/81/BR	0.6	2.0	25.5	7.3	58.2	14.4	1.3	0.4	43.2
617/83/BR	0.5	2.9	18.7	6.1	74.5	11.0	2.0	0.5	37.2
Jumbo/BR	0.4	4.8	10.3	4.1	71.3	14.3	0.7	1.0	29.3
986/84/BR	0.5	5.2	21.8	2.7	65.8	12.0	0.0	0.0	38.5
Dombito/BR	0.8	6.6	36.6	13.5	46.2	12.9	1.3	4.1	47.2
Tropic VF/ST	0.7	6.1	12.3	11.7	73.3	20.3	3.0	1.3	43.4
Ont. Pink 774/ST	0.6	1.7	44.1	8.0	70.7	2.7	0.4	0.0	52.6
LSD 5%	0.2	2.8	10.7	3.4	17.1	5.1	2.9	1.8	11.9

[z]Percentage of the fruit that had more than one physiological disorder.

Literature Cited

1. Erb, W.A., N.J. Flickinger and J.J. Sonowski. 1988. Greenhouse tomato breeding fall crop 1987 evaluation trials, Wooster. Horticulture Series No. 589.

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